

Physician intervention to positive depression screens among adolescents in primary care

Matthew C. Aalsma, PhD¹
 Ashley M. Zerr, MD²
 Dillon J. Etter, MPH¹
 Fangqian Ouyang, MS³
 Amy Lewis Gilbert, JD, MPH⁴
 Rebekah L. Williams, MD¹
 James A. Hall, PhD¹
 Stephen M. Downs, MD, MS⁴

Affiliations: ¹ Section of Adolescent Medicine, Department of Pediatrics, Indiana University School of Medicine, Indianapolis IN

² Department of Pediatrics, University of Louisville School of Medicine, Louisville KY

³ Department of Biostatistics, Indiana University Richard M. Fairbanks School of Public Health, Indianapolis IN

⁴ Children's Health Services Research, Department of Pediatrics, Indiana University School of Medicine, Indianapolis IN

Corresponding author: Matthew C. Aalsma, PhD; 410 W. 10th Street, Indianapolis, Indiana, 46202; Email: maalsma@iu.edu, Telephone: 317.278.7135, Fax: 317.274.0133

Acknowledgement: This study was funded by a grant from AHRQ R01HS022681. The authors wish to thank the CHIRDL programing team for their work in completing this project. We would also like to thank Margaret J. Blythe, MD and Laura M. Kester, MD for their support of this project and help in adapting the depression treatment algorithm.

Clinical Trials Registry: NCT02244138

Abbreviations: computer decision support system (CDSS); Child Health Improvement through Computer Automation (CHICA); provider worksheet (PWS); Patient Health Questionnaire (PHQ)

Implications and Contribution: Professional organizations recommend adolescent depression screening when appropriate interventions are available. Little is known about how computer-based decision support systems (CDSS) can aid physicians in treating adolescent depression. This study demonstrates that a CDSS focused on adolescent depression can inform the primary care practice of physicians.

This is the author's manuscript of the article published in final edited form as:

Aalsma, M. C., Zerr, A. M., Etter, D. J., Ouyang, F., Gilbert, A. L., Williams, R. L., ... Downs, S. M. (2018). Physician Intervention to Positive Depression Screens Among Adolescents in Primary Care. *Journal of Adolescent Health*, 62(2), 212–218. <https://doi.org/10.1016/j.jadohealth.2017.08.023>

Recent national data have shown that the annual prevalence of depression among adolescents has increased from 8.7% in 2005 to 11.3% in 2014.¹ An increasing prevalence in adolescent depression is concerning since depression can have significant consequences for youth including academic difficulty, comorbid mental health problems, and suicidal thoughts.²⁻⁴ Given that depression can have significant consequences, is treatable, and can reoccur across the lifespan,⁵ professional organizations have included routine screening for depression in their preventive health recommendations. For instance, a recent recommendation by the United States Preventive Services Task Force is that yearly adolescent depression screening⁶ should occur, starting at age 12, in situations where appropriate follow-up is possible.⁷ Despite these recommendations, however, physician implementation of preventive services (including depression screening) is only 34.5%.⁸ Thus, it is important and possible to improve physician treatment of adolescent depression.⁹

A combination of shortened visit times, low physician self-efficacy in relation to screening, and concerns over how to interpret and intervene with positive depression screens contribute to low screening compliance.¹⁰⁻¹² It has been shown, however, that the use of standardized depression screening tools validated with adolescents, such as the Patient Health Questionnaire (PHQ-2 and PHQ-9), can improve rates of depression symptom identification in primary care clinics.¹³⁻¹⁵ Once depression has been identified, physician compliance with adolescent depression treatment recommendations – including recommendations to refer youth to specialized mental health treatment – is largely unknown.¹⁰ One recent survey, however, found that whereas 60% of physicians report screening children and youth for depression, only 64% report referring depressed youth to community treatment, and only 24% report treating, managing or co-managing the treatment of depressed youth in primary care.¹⁶

One demonstrated method for increasing preventive care screening and encouraging appropriate physician responses to positive screening results in other contexts, is the implementation of computer decision support systems (CDSS). Studies with adults have found that using a CDSS can improve the primary care management of depression.^{17,18} The present study evaluates how the integration of automated depression screening and response-driven physician management prompts into a primary care CDSS impacts physician identification and reported treatment of adolescent depression symptoms.

METHODS

CHICA System Overview

The Child Health Improvement through Computer Automation (CHICA) System is a CDSS that integrates electronic medical record (EMR) system data, pre-visit screening data, and correlative physician responses from previous visits to generate appropriate follow-up screening recommendations, tools, and physician prompts.

When a patient checks into a clinic, the CHICA system automatically generates a Pre-Screener Form (PSF) based on information in the patient's EMR, including age, current medical conditions, and known risk factors for morbidity based on the child's developmental stage and medical conditions. The PSF is administered on an electronic tablet and is completed prior to the physician encounter. It consists of two parts: 1) a form for the nurse to record patient vitals, height, and weight; and 2) a 20-item patient questionnaire on a variety of health-related topics such as diet, depression, sexual behaviors, and substance use. For patients aged 12 and older, instructions at the top of the patient questionnaire advise that adolescents should answer the questions on their own behalf. Follow-up items to the 20-item screener are immediately, and electronically, administered when necessary.

A provider worksheet (PWS) is generated based on patient responses to the PSF items. The PWS is printed and given to the physician for follow-up. Partially completed PSFs still generate a PWS. The PWS consists of 6 physician prompts with corresponding check boxes. When a physician responds to worksheet prompts, the form is scanned and uploaded by clinic staff after the patient encounter. The CHICA system analyzes physician responses using optical mark and character recognition to detect which action items were reported by the physician and then records the appropriate actions in a database. Together, PSF and PWS provide screening and correlative options for physician follow-up. More detailed information about CHICA--including rule processing, development of Arden rules, data storage, and implementation--can be found in previous publications.^{19,20} When the system was first implemented, CHICA users, including physicians and clinic staff, completed a brief training led by the creators of CHICA. An electronic newsletter alerts all users of new CHICA modules being tested. In addition to quarterly meetings regarding CHICA operation, CHICA users may contact the CHICA developers or other research staff directly regarding questions or concerns with the system. Additionally, CHICA support staff make regular visits to participating clinics to maintain rapport with clinic staff, troubleshoot any technical issues, and answer any questions that staff members may have about the CHICA system.

Study Design and Depression Screening Process

Adolescents aged 12-20 who presented to their pediatric primary care clinic for an annual (non-sick) or sick visit between October, 2014, and October, 2015, were selected to participate in the prospective cohort study. It should be noted that the current study is part of an ongoing controlled clinical trial, using a subset of data from the intervention sites only. The depression CDSS module was implemented in 2 clinic sites (clinic A and clinic B). Although most

adolescents were seen by pediatricians during usual primary care clinic hours, some adolescents were seen during onsite adolescent clinic hours by fellowship-trained adolescent medicine physicians with adolescent health specific nursing support. Both clinic sites are part of a Midwest county hospital system (Eskenazi Health). IRB approval was received by the local university and honored by the hospital system in which the study took place.

For this study, the PSF included an adaptation of a brief two-item depression screener, the Patient Health Questionnaire-2 (PHQ-2).²¹ If the patient answered “yes” to either question in the PHQ-2, a longer nine-item depression screener, the Patient Health Questionnaire-9 (PHQ-9)¹³ was automatically administered at the end of the 20-item screener. The PHQ-2 and PHQ-9 are the recommended screening sequence among adolescent populations.⁷ An example item from the PHQ-2 is “During the past few weeks, have you felt very sad or down as though you have nothing to look forward to?” The sensitivity of the PHQ-2 and PHQ-9 are 74% and 96% respectively, with a specificity of 75% and 82%.^{13,21}

The PHQ-9 was automatically scored by CHICA. A score of 0-4 points indicates minimal/no depression symptoms, 5-9 mild depression symptoms, 10-14 moderate depression symptoms, 15-19 moderately severe and 20+ severe depression symptoms.²² A score ≥ 5 was considered a positive depression screen for this study. Moderately severe and severe categories were collapsed into one “severe” category for the purposes of this study. In the case of a positive depression screen, the PHQ-9 score and associated action items were printed on the PWS. For example, a moderate PHQ-9 score generated the physician prompt shown in Figures 1 and 2. Physician prompts were based on the Guidelines for Adolescent Depression-Primary Care (GLAD-PC) from the American Academy of Pediatrics.²³ Physicians indicated which actions they performed or intended to perform by checking boxes next to the corresponding action items.

Physician feedback regarding potential selective serotonin reuptake inhibitor (SSRI) use were included for youth with PHQ-9 scores in the moderate and severe range. For example, a positive depression screen for a patient not already taking an SSRI would generate a prompt seen in Figure 2.

Chart Abstraction

Data on physician responses were captured through the CHICA system. However, in some cases, the physicians did not indicate a response to a depression alert in CHICA. In cases where patients screened positive for depression symptoms and no physician responses were recorded on the PWS, a chart review was conducted by trained research assistants to see if physicians took action but failed to mark the corresponding check box on the PWS. Data from the chart review were added to the database and included in the final analysis.

Analyses

Descriptive statistics [means, standard deviations (SD), and frequencies] were calculated for patient demographics, clinic site, clinic type, PHQ-9 scores, and reported physician follow-up at the first visit during the study time frame for both the overall sample and the subset that screened positive for depression symptoms. We then calculated the prevalence of positive depression screening and described reported physician treatment practices for depression. Fisher's exact test was performed to compare prevalence among depression groups (mild, moderate and severe). Lastly, we conducted logistic regression analyses to model reported physician mental health referral and SSRI initiation using the following predictors: gender, race, age (early, middle, and late adolescence), clinic site (clinic A, clinic B), clinic type (general pediatric, adolescent medicine) and PHQ-9 score (mild, moderate, and severe).

RESULTS

Our sample population included 2,038 youth [51% female; 60% Black; mean age=14.6 years (SD=2.1)]. See demographic information for overall sample and youth that scored above 5 on the PHQ-9 in Table 1. Just over 20% of youth (21.2%) screened positive for depression symptoms on the PHQ-2 (see flow-chart in Figure 3 which outlines depression screening of youth in primary care). Of the 434 youth with a positive PHQ-2 screen, 121 scored 0-4 on the PHQ-9 (27.8%) and 303 (69.8%) scored 5 or above [63% female; 60% Black; mean age=15.2 years (SD=2.1)], indicating possible depression. Of those 303 youth, 149 scored in the mild range (5-10, 49.1%), 132 scored in the moderate range (11-15, 43.5%) and 22 scored in the severe range (above 15; 7.2%).

Looking first at data contained in the CHICA system, 60% (n=181) of records with a positive depression screen showed no reported physician action on the PWS. With the addition of data gathered via chart review and visual inspection of the PWS, this number decreased by 135 indicating that only 15% (46 records) of youth that screened 5 or above on the PHQ-9 had no documented physician follow-up. Thirty percent of records included in the chart review were audited by a second research assistant with 94% inter-rater agreement and a pooled kappa of $\kappa=0.27$. A low kappa value despite high agreement is likely due to the low prevalence of certain follow-up items as kappa is known to be affected by imbalanced marginal totals.²⁴ In all, physicians documented follow-up actions (either on the PWS or in the patient chart) 91% of the time for youth in the mild depression range, 93% of the time for youth in the moderate range, and 100% of the time for youth in the severe range.

Physician responses are detailed in Table 2. The follow-up categories are not mutually exclusive and physicians can check all that apply to that encounter with a youth. A significant minority of youth in the mild (22.8%) and moderate (19.7%) range were not depressed, based on

physician follow-up during the encounter. All youth that scored in the severe range were determined to be depressed by physicians. Additionally, 12.8% of youth in the mild range, 6.1% of youth in the moderate range, and 18.2% of youth in the severe range were already receiving treatment at the time of visit. Of the remaining 183 (60.3%) adolescents that screened positive, the most commonly reported follow-up action by physicians was referral to mental health services (34.2% mild, 46.8% moderate, and 72.2% severe range).

Steps for the possible initiation of SSRIs were also assessed. Almost 11% of youth in the moderate range and 22.7% of youth in the severe range were already prescribed an SSRI. A minority of youth (26.7% of youth in the moderate range and 9.1% of youth in the severe range) were either not interested in an SSRI, or the physician determined they were not good candidates for an SSRI. Of youth who scored in the moderate and severe range, 8.4% and 31.8% respectively began an SSRI at the primary care visit according to physician-reported data. A number of tests commonly related to the initiation of an SSRI were also conducted (see Table 2).

Two logistic regression models were developed to model predictors of physician follow-up actions. The first focused on youth in the mild, moderate or severe range who were not already in treatment and who physicians determined were depressed (N=215). The outcome was physician-reported referral to mental health services. Predictors included youth gender, race, age group, clinic site (clinic A, clinic B), clinic type (general pediatric, adolescent medicine) and PHQ-9 score (mild, moderate, and severe). Age groups were defined as follows: early adolescence 12-15 years, middle adolescence 15-17 years, and late adolescence 18-20 years. Significant predictors in the multivariate analysis included clinic site [40.2% clinic A vs. 73.9% clinic B; AOR 4.46 (2.43, 8.18); $p \leq 0.0001$] and PHQ-9 score [severe 77.8% vs. mild 47.5%; AOR 4.66 (1.36, 15.97); $p \leq 0.01$]. Youth demographic characteristics and clinic type (general

pediatric vs. adolescent medicine) did not predict physician-reported referral to mental health services.

A second model focused on youth in the moderate or severe range who were not already prescribed an SSRI and who were interested in exploring an SSRI (N=100). The outcome was physician-reported initiation of SSRI. Predictors were identical to those in the first model. Similar to the first model, only clinic site [28.6% vs. 6.9%; AOR 6.48 (1.69, 24.80); $p \leq 0.01$] and depression score [severe range 46.7% vs. moderate range 10.6%; AOR 9.01 (2.28, 36.30); $p \leq 0.001$] were significant. Youth demographics and clinic type did not predict physician reported initiation of an SSRI.

DISCUSSION

Depression is a common condition among adolescents and even with preventive screening guidelines, the rates of screening, diagnosing, and treatment of adolescent depression remain low.²⁵ It is vitally important to identify youth at-risk for depression, given the poor outcomes experienced by depressed youth. Primary care is an ideal setting to identify, diagnosis and treat depression.⁸ This study demonstrates that it is possible to successfully implement a depression algorithm within an existing CDSS that both screens and identifies youth at risk for depression symptoms. This study also shows the extent to which physicians using the algorithm report adherence to adolescent depression treatment guidelines recommended by the system when youth are identified as at-risk for depression. Below we discuss the findings of the current study in relation to previous research.

In the current study, 20% of adolescents screened positive for depression symptoms using the PHQ-2. This rate falls within the range of 12-26% reported by previous studies of depression screeners among adolescents.^{13,25-28} Similarly, 14% of youth scored in the mild, moderate, or

severe range on the PHQ-9. As in previous studies,^{26,27} our findings demonstrate the feasibility of using the PHQ-2 and PHQ-9 as computer-based depression screening for adolescents in a primary care setting.

Physician Feedback and Anticipatory Guidance

To further evaluate physician follow-up, our study implemented physician prompts for each depression screen in the mild, moderate, and severe range (See Table 2). Studies of CDSS have shown that 49-96% of CDSS alerts are ignored by physicians.^{29,30} In the current study, we found that physicians definitively checked a box on the PWS indicating that they had received the alert and responded in some manner only 40% of the time. Upon chart review, however, we found that physicians actually responded to positive depression screens 85% of the time, suggesting that providers may have been guided by the decision support, even if they did not check the appropriate box. This discrepancy warrants further research, as ignoring a CDSS alert can result in physician practices that are not aligned with evidence-based standards.³¹ This also highlights the need to conduct chart reviews when initially implementing CDSS to monitor the possibility of noncompliance.

Although 85% of physicians ultimately took action based on positive depression screens, 15% did not. Potential contributing factors noted in the CDSS literature include “alert fatigue,”^{32,33} experience with the CDSS, perceived importance of the topic, ease of physician guidance, physicians’ level of comfort with the topic,³⁴ and positioning of a prompt on the page.³⁵ Regardless, this finding highlights a need to continue working toward reduced physician burden in CDSS implementation. Additionally, it is recommended that automated CDSS data collection methods, such as accessing and integrating information in the chart note, be improved to more accurately assess physician behavior.

In general, physicians responded with more extensive follow-up for youth with more severe depression symptoms. This was not true, however, in the case of the lifestyle changes handout. Physicians reported using this handout more often with mildly and moderately depressed youth than with severely depressed youth. Based on this finding, it is possible that physicians reported utilizing the handout for patients when they did not feel a mental health referral was necessary but felt the teen could benefit from anticipatory guidance regarding lifestyle changes to improve their mood. Although studies on anticipatory guidance specifically related to adolescent depression are limited, the general utility of anticipatory guidance is well documented in the literature and applicable to the prevention of adolescent depression.^{34,35}

Our regression models revealed that only clinic site and PHQ-9 score predicted both physician-reported mental health referral and SSRI initiation. Youth demographic information such as age, race/ethnicity and gender did not predict these practices. This is an important and promising finding given the well-documented existence of racial and ethnic disparities in depression treatment.³⁶ Of note, most patients sampled were Medicaid insured, limiting the opportunity to detect outcome variation related to patients' socioeconomic status.

Physician Follow-up Regarding SSRI

In assessing reported physician behavior regarding prescription of SSRIs, over 30% of youth with a PHQ-9 score in the severe range were reportedly started on an SSRI, compared to under 10% of youth who scored in the moderate range. Physicians were much more likely to document that youth in the moderate range did not need medication in the physician assessment. We were unable to determine whether an SSRI was not initiated because the adolescent was not a good candidate or because the adolescent was not interested. Previous research has found roughly 50% of youth with depression were reluctant or refused to initiate psychiatric

medication.³⁷ Thus, further research is needed to determine if it would be helpful to build a psychiatric decision aide into CHICA to help the adolescent (and caregiver) determine whether an SSRI might be beneficial. This finding also highlights the fact that further research is needed to improve rates of SSRI initiation in primary care settings with adolescents.

Limitations

There are some limitations to the current study. The CHICA system has been implemented in general pediatric clinics for over 10 years. Over 85% of the youth seen in these clinic are under the age of 12. For this reason, the clinics have traditionally asked parents to complete the patient questionnaire on their child's behalf. With the advent of the adolescent depression module in CHICA, instructions advising caregivers to have children 12 and older answer on their own behalf were implemented. Unfortunately, we have no way of knowing whether adolescents completed the PHQ-2 and PHQ-9 on their own behalf for this study. The rate of endorsement in our clinic sample was similar to that of other primary care clinics, however, increasing the face validity of our findings.^{13,25-28} Moving forward, future studies of CDSS screening mechanisms should focus on methods for ensuring adolescent self-report. Additionally, we are unable to determine whether or not physicians and patients followed through with physician-reported follow-up actions. For example, it is possible that a physician reported referring a patient for psychiatric evaluation and the patient did not complete the referral. Therefore, we cannot say definitively that our findings showed physician adherence to guidelines—only that physicians *documented* adherence.

This study was implemented into one health care system, and the generalizability of its findings to other settings may therefore be limited. Additionally, we did find significant clinic variability in mental health referral and initiation of SSRI by physicians. We did not study

organizational factors in the current study and were unable to determine the cause of the clinic variability. Future research may be warranted to identify organizational barriers that impact physician-reported adherence to adolescent depression treatment guidelines. Because the CDSS generated a hardcopy physician worksheet, rather than additional electronic guidance for physicians, future research should explore the effects of a CDSS that is fully and automatically integrated within an EMR. Lastly, although chart reviews revealed that more physicians followed adolescent treatment guidelines for depression than the CDSS responses suggested, we cannot say with certainty that this improved adherence was caused by the adolescent depression treatment CDSS algorithm.

CONCLUSION

In summary, screening for adolescent depression is a practice that can be implemented into the annual physical exam using well-established screening tools that are integrated into a CDSS. As the current study demonstrates, there continue to be barriers to successfully implementing CDSS into everyday practice. However, the study also demonstrates that physician behavior can be supported to more accurately reflect treatment guidelines for the treatment of adolescent depression.

REFERENCES

1. Mojtabai R, Olfson M, Han B. National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*. 2016;138(6).
2. Pomerantz EM, Altermatt ER, Saxon JL. Making the grade but feeling distressed: Gender differences in academic performance and internal distress. *J Educ Psychol*. 2002;94(2):396.
3. Kessler RC, Avenevoli S, McLaughlin K, Green JG, Lakoma M, Petukhova M, Pine D, Sampson N, Zaslavsky A, Merikangas KR. Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychol Med*. 2012;42(09):1997-2010.
4. Weissman MM, Wolk S, Goldstein RB, Moreau D, Adams P, Greenwald S, Klier CM, Ryan ND, Dahl RE, Wickramaratne P. Depressed adolescents grown up. *JAMA*. 1999;281(18):1707-1713.
5. Rohde P, Lewinsohn PM, Klein DN, Seeley JR, Gau JM. Key characteristics of major depressive disorder occurring in childhood, adolescence, emerging adulthood, and adulthood. *Clin Psychol Sci*. 2013;1(1):41-53.
6. American Academy of Pediatrics. 2016 recommendations for preventive pediatric health care. *Pediatrics*. 2016;137(1):25-27.
7. Siu AL. Screening for depression in children and adolescents: US Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2016;164:I-28.
8. Mangione-Smith R, DeCristofaro AH, Setodji CM, Keesey J, Klein DJ, Adams JL, Schuster MA, McGlynn EA. The quality of ambulatory care delivered to children in the United States. *N Engl J Med*. 2007;357(15):1515-1523.

9. Gadoński AM., Fothergill KE, Larson S, Wissow LS, Winegrad H, Nagykaldi ZJ, Olson AL, Roter DL. Integrating mental health into adolescent annual visits: Impact of previsit comprehensive screening on within-visit processes. *J Adolesc Health* 2015;56(3): 267-273.
10. Wissow LS, Brown J, Fothergill KE, Gadoński A, Hacker K, Salmon P, Zelkowitz R. Universal mental health screening in pediatric primary care: A systematic review. *J Am Acad Child Adolesc Psychiatry*. 2013;52(11):1134-1147. e1123.
11. Buckelew SM, Adams SH, Irwin CE, Gee S, Ozer EM. Increasing clinician self-efficacy for screening and counseling adolescents for risky health behaviors: Results of an intervention. *J Adolesc Health*. 2008;43(2):198-200.
12. Fallucco EM, Conlon MK, Gale G, Constantino JN, Glowinski AL. Use of a standardized patient paradigm to enhance proficiency in risk assessment for adolescent depression and suicide. *J Adolesc Health*. 2012;51(1):66-72.
13. Richardson LP, McCauley E, Grossman DC, McCarty CA, Richards J, Russo JE, Rockhill C, Katon W. Evaluation of the Patient Health Questionnaire-9 item for detecting major depression among adolescents. *Pediatrics*. 2010;126(6):1117-1123.
14. Sudhanthar S, Thakur K, Sigal Y, Turner J. Improving validated depression screen among adolescent population in primary care practice using electronic health records (EHR). *BMJ Qual Improvement Rep*. 2015;4(1).
15. Trivedi MH, Kern JK, Grannemann BD, Altshuler KZ, Sunderajan P. A computerized clinical decision support system as a means of implementing depression guidelines. *Psychiatr Serv*. 2004;55(8):879-885.

16. Stein REK, Storer-Isser A, Kerker BD, Garner A, Szilagyi M, Hoagwood KE, O'Connor KG, Horwitz SM. Beyond ADHD: How well are we doing? *Acad Pediatr*. 2015.
17. Korsen N, Scott P, Dietrich AJ, Oxman T. Implementing an office system to improve primary care management of depression. *Psychiatr Q*. 2003;74(1):45-60.
18. Kroenke K, Taylor-Vaisey A, Dietrich AJ, Oxman TE. Interventions to improve provider diagnosis and treatment of mental disorders in primary care. A critical review of the literature. *Psychosomatics*. 2000;41(1):39-52.
19. Anand V, Biondich PG, Liu G, Rosenman M, Downs SM. Child health improvement through computer automation: The CHICA system. *Stud Health Technol Inform*. 2004;107(Pt 1):187-191.
20. Carroll AE, Bauer NS, Dugan TM, Anand V, Saha C, Downs SM. Use of a computerized decision aid for ADHD diagnosis: A randomized controlled trial. *Pediatrics*. 2013;132(3):e623-e629.
21. Richardson LP, Rockhill C, Russo JE, Grossman DC, Richards J, McCarty C, McCauley E, Katon W. Evaluation of the PHQ-2 as a brief screen for detecting major depression among adolescents. *Pediatrics*. 2010;125(5):e1097-e1103.
22. Kroenke K, Spitzer RL, Williams JB. The PHQ-9. *J Gen Intern Med*. 2001;16(9):606-613.
23. Zuckerbrot RA, Cheung AH, Jensen PS, Stein RE, Laraque D. Guidelines for adolescent depression in primary care (GLAD-PC): Identification, assessment, and initial management. *Pediatrics*. 2007;120(5):e1299-e1312.
24. Feinstein AR, Cicchetti DV. High agreement but low Kappa: The problems of two paradoxes. *J Clin Epidemiol*. 1990;43(6):543-549.

25. Ozer EM, Zahnd EG, Adams SH, Husting SR, Wibbelsman CJ, Norman KP, Smiga SM. Are adolescents being screened for emotional distress in primary care? *J Adolesc Health*. 2009;44(6):520-527.
26. Paperny DM, Aono JY, Lehman RM, Hammar SL, Risser J. Computer-assisted detection and intervention in adolescent high-risk health behaviors. *Pediatrics*. 1990;116(3):456-462.
27. Chisolm DJ, Gardner W, Julian T, Kelleher KJ. Adolescent satisfaction with computer-assisted behavioural risk screening in primary care. *Child Adolesc Ment Health*. 2008;13(4):163-168.
28. Fein JA, Pailler ME, Barg FK, Wintersteen MB, Hayes K, Tien AY, Diamond GS. Feasibility and effects of a web-based adolescent psychiatric assessment administered by clinical staff in the pediatric emergency department. *Arch Pediatr Adolesc Med*. 2010;164(12):1112-1117.
29. van der Sijs H, Mulder A, van Gelder T, Aarts J, Berg M, Vulto A. Drug safety alert generation and overriding in a large Dutch university medical centre. *Pharmacoepidemiol Drug Saf*. 2009;18(10):941-947.
30. Bauer NS, Carroll AE, Saha C, Downs SM. Experience with decision support system and comfort with topic predict clinicians' responses to alerts and reminders. *J Am Med Inform Assoc*. 2016;23(e1):e125-130.
31. Coiera E, Aarts J, Kulikowski C. The dangerous decade. *J Am Med Inform Assoc*. 2012;19(1):2-5.
32. Collins S, Currie L, Patel V, Bakken S, Cimino JJ. Multitasking by clinicians in the context of CPOE and CIS use. *Stud Health Technol Inform*. 2007;129(Pt 2):958-962.

33. Carroll AE, Anand V, Downs SM. Understanding why clinicians answer or ignore clinical decision support prompts. *Appl Clin Inform.* 2012;3(3):309-317.
34. González HM, Vega WA, Williams DR, Tarraf W, West BT, Neighbors HW. Depression care in the United States: Too little for too few. *ArchGen Psychiatr.* 2010;67(1):37-46.
35. Stein REK, Zitner LE, Jensen PS. Interventions for adolescent depression in primary care. *Pediatrics.* 2006;118.2: 669-682.
36. Alegría M, Chatterji P, Wells K, Cao Z, Chen CN, Takeuchi D, Jackson J, Meng XL. Disparity in depression treatment among racial and ethnic minority populations in the United States. *Psychiatr Serv.* 2008;59(11):1264-1272.
37. DeBar LL, Clarke GN, O'Connor E, Nichols GA. Treated prevalence, incidence, and pharmacotherapy of child and adolescent mood disorders in an HMO. *Ment Health Serv Res.* 2001;3(2):73-89.

Figure 1. Example Physician Prompt – Moderate Depression

<input type="checkbox"/> Subject		CHCA Physician Encounter Form		99
Patient: Family, Jane (2) DOB: 11/18/1942 Race: White Male		MRN: 151 Date: 03/1/2004 Time: 3:05PM	Information: 01	
A Vital Signs <i>review only</i> Temp: 36.2 Pulse: 72 BP: 115/70 SpO2: 98% RR: 18 Weight: 175 Height: 5'10"		<input type="checkbox"/> Ignore Sved Count <input type="checkbox"/> Tachy Dysrhythmia <input type="checkbox"/> Normal for above <input type="checkbox"/> Decreased physical activity <input type="checkbox"/> Decreased appetite due to: - Fatigue X - Anxious symptoms - Drug side-effects <input type="checkbox"/> Medication Education Preferred; no discussion on Venous Thromboembolism		
Date: 03/01/2004		Information: 01 Information: 01 Information: 01		
Allergies: no known allergies (P2002) (code 01 or 02 or 03 or 04 or 05 or 06 or 07 or 08 or 09 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113 or 114 or 115 or 116 or 117 or 118 or 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 139 or 140 or 141 or 142 or 143 or 144 or 145 or 146 or 147 or 148 or 149 or 150 or 151 or 152 or 153 or 154 or 155 or 156 or 157 or 158 or 159 or 160 or 161 or 162 or 163 or 164 or 165 or 166 or 167 or 168 or 169 or 170 or 171 or 172 or 173 or 174 or 175 or 176 or 177 or 178 or 179 or 180 or 181 or 182 or 183 or 184 or 185 or 186 or 187 or 188 or 189 or 190 or 191 or 192 or 193 or 194 or 195 or 196 or 197 or 198 or 199 or 200 or 201 or 202 or 203 or 204 or 205 or 206 or 207 or 208 or 209 or 210 or 211 or 212 or 213 or 214 or 215 or 216 or 217 or 218 or 219 or 220 or 221 or 222 or 223 or 224 or 225 or 226 or 227 or 228 or 229 or 230 or 231 or 232 or 233 or 234 or 235 or 236 or 237 or 238 or 239 or 240 or 241 or 242 or 243 or 244 or 245 or 246 or 247 or 248 or 249 or 250 or 251 or 252 or 253 or 254 or 255 or 256 or 257 or 258 or 259 or 260 or 261 or 262 or 263 or 264 or 265 or 266 or 267 or 268 or 269 or 270 or 271 or 272 or 273 or 274 or 275 or 276 or 277 or 278 or 279 or 280 or 281 or 282 or 283 or 284 or 285 or 286 or 287 or 288 or 289 or 290 or 291 or 292 or 293 or 294 or 295 or 296 or 297 or 298 or 299 or 300 or 301 or 302 or 303 or 304 or 305 or 306 or 307 or 308 or 309 or 310 or 311 or 312 or 313 or 314 or 315 or 316 or 317 or 318 or 319 or 320 or 321 or 322 or 323 or 324 or 325 or 326 or 327 or 328 or 329 or 330 or 331 or 332 or 333 or 334 or 335 or 336 or 337 or 338 or 339 or 340 or 341 or 342 or 343 or 344 or 345 or 346 or 347 or 348 or 349 or 350 or 351 or 352 or 353 or 354 or 355 or 356 or 357 or 358 or 359 or 360 or 361 or 362 or 363 or 364 or 365 or 366 or 367 or 368 or 369 or 370 or 371 or 372 or 373 or 374 or 375 or 376 or 377 or 378 or 379 or 380 or 381 or 382 or 383 or 384 or 385 or 386 or 387 or 388 or 389 or 390 or 391 or 392 or 393 or 394 or 395 or 396 or 397 or 398 or 399 or 400 or 401 or 402 or 403 or 404 or 405 or 406 or 407 or 408 or 409 or 410 or 411 or 412 or 413 or 414 or 415 or 416 or 417 or 418 or 419 or 420 or 421 or 422 or 423 or 424 or 425 or 426 or 427 or 428 or 429 or 430 or 431 or 432 or 433 or 434 or 435 or 436 or 437 or 438 or 439 or 440 or 441 or 442 or 443 or 444 or 445 or 446 or 447 or 448 or 449 or 450 or 451 or 452 or 453 or 454 or 455 or 456 or 457 or 458 or 459 or 460 or 461 or 462 or 463 or 464 or 465 or 466 or 467 or 468 or 469 or 470 or 471 or 472 or 473 or 474 or 475 or 476 or 477 or 478 or 479 or 480 or 481 or 482 or 483 or 484 or 485 or 486 or 487 or 488 or 489 or 490 or 491 or 492 or 493 or 494 or 495 or 496 or 497 or 498 or 499 or 500 or 501 or 502 or 503 or 504 or 505 or 506 or 507 or 508 or 509 or 510 or 511 or 512 or 513 or 514 or 515 or 516 or 517 or 518 or 519 or 520 or 521 or 522 or 523 or 524 or 525 or 526 or 527 or 528 or 529 or 530 or 531 or 532 or 533 or 534 or 535 or 536 or 537 or 538 or 539 or 540 or 541 or 542 or 543 or 544 or 545 or 546 or 547 or 548 or 549 or 550 or 551 or 552 or 553 or 554 or 555 or 556 or 557 or 558 or 559 or 560 or 561 or 562 or 563 or 564 or 565 or 566 or 567 or 568 or 569 or 570 or 571 or 572 or 573 or 574 or 575 or 576 or 577 or 578 or 579 or 580 or 581 or 582 or 583 or 584 or 585 or 586 or 587 or 588 or 589 or 590 or 591 or 592 or 593 or 594 or 595 or 596 or 597 or 598 or 599 or 600 or 601 or 602 or 603 or 604 or 605 or 606 or 607 or 608 or 609 or 610 or 611 or 612 or 613 or 614 or 615 or 616 or 617 or 618 or 619 or 620 or 621 or 622 or 623 or 624 or 625 or 626 or 627 or 628 or 629 or 630 or 631 or 632 or 633 or 634 or 635 or 636 or 637 or 638 or 639 or 640 or 641 or 642 or 643 or 644 or 645 or 646 or 647 or 648 or 649 or 650 or 651 or 652 or 653 or 654 or 655 or 656 or 657 or 658 or 659 or 660 or 661 or 662 or 663 or 664 or 665 or 666 or 667 or 668 or 669 or 670 or 671 or 672 or 673 or 674 or 675 or 676 or 677 or 678 or 679 or 680 or 681 or 682 or 683 or 684 or 685 or 686 or 687 or 688 or 689 or 690 or 691 or 692 or 693 or 694 or 695 or 696 or 697 or 698 or 699 or 700 or 701 or 702 or 703 or 704 or 705 or 706 or 707 or 708 or 709 or 710 or 711 or 712 or 713 or 714 or 715 or 716 or 717 or 718 or 719 or 720 or 721 or 722 or 723 or 724 or 725 or 726 or 727 or 728 or 729 or				

[Patient name] reports moderate depression. PHQ 9 score of 12.0 on [screening date]. Schedule follow-up in 4-6 weeks.

- ☐ Discuss lifestyle changes
- ☐ Provide crisis line contact
- ☐ In treatment/not interested
- ☐ Reviewed support handout
- ☐ Refer to psychotherapy
- ☐ Not depressed

Figure 2. Example Physician Prompt – SSRI

CHICA Physician Encounter Form		992
Patient: Prince, Lisa (F) DOR: 12/1/19 Age: 18 yr Doctor: Yada, David, MD		MRN: 592 Date: Oct 7 2019 Time: 3:10 PM Informant: self
Vital Signs: arranging - stable Weight: <input type="checkbox"/> Special Diet Child BMI: <input type="checkbox"/> Two ID's Checked Head Circ: <input type="checkbox"/> Screened for abuse Temp: <input type="checkbox"/> Decreased physical activity Pulse: <input type="checkbox"/> Decreased healthy diet BP: <input type="checkbox"/> Tobacco N Pulse Ox: <input type="checkbox"/> Alcohol Intake N Weight: <input type="checkbox"/> Drug Intake N Press: N/A		
Medication Education Performed and/or Consented on: <input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A		
Abuse A=Abuse, B=Physical, C=Sexual		
Has signs/symptoms of depression: PHQ-9 score of 12.0 on 10/07/19. Schedule follow-up in 4-6 weeks.		
For patients with moderate or severe depression, labs and SSRI are recommended. For SSRI, please consult to contact every 2 wks until stable.		
<input checked="" type="checkbox"/> Discuss safety changes <input type="checkbox"/> Provide crisis line contact <input type="checkbox"/> The treatment is discussed		
<input checked="" type="checkbox"/> Screened support/insult <input checked="" type="checkbox"/> Refer to psychotherapy <input type="checkbox"/> Not depressed		
<input checked="" type="checkbox"/> Started SSRI <input type="checkbox"/> Already on SSRI <input type="checkbox"/> Not depressed		
<input checked="" type="checkbox"/> Monitor q2wk <input type="checkbox"/> THS, Free T4 Ordered <input type="checkbox"/> CBC, UPT		
Confidential consultation (or parent is consent) recommended if <17 years. Check all that apply:		
<input type="checkbox"/> Not confidential <input type="checkbox"/> Part of treatment <input type="checkbox"/> Not confidential <input type="checkbox"/> Not possible <input type="checkbox"/> Not confidential <input type="checkbox"/> Not appropriate		
According to AAP guidelines, has child been a victim concerning today, but we have no record. Please consult track doc:		
<input checked="" type="checkbox"/> Screen done <input type="checkbox"/> Screen <input type="checkbox"/> Unable to screen <input type="checkbox"/> Not indicated		
Has child not indicated sexual activity. Anticipatory guidance is a good idea. Please see following:		
<input type="checkbox"/> Sexually active <input type="checkbox"/> Sex in progress - not <input checked="" type="checkbox"/> Not sexual		
<input type="checkbox"/> Shows not condoms <input type="checkbox"/> Prescribed birth control <input checked="" type="checkbox"/> Provide relationship guidance		
<input type="button" value="Submit"/>		

For patients with moderate or severe depression, labs and SSRI are recommended. New SSRI patient should be contacted every 2 wks until stable.

- ☐ Started SSRI
- ☐ Already on SSRI
- ☐ Not depressed
- ☐ Monitor q2wk
- ☐ THS, Free T4 Ordered
- ☐ CBC, UPT

Figure 3. Flow Diagram

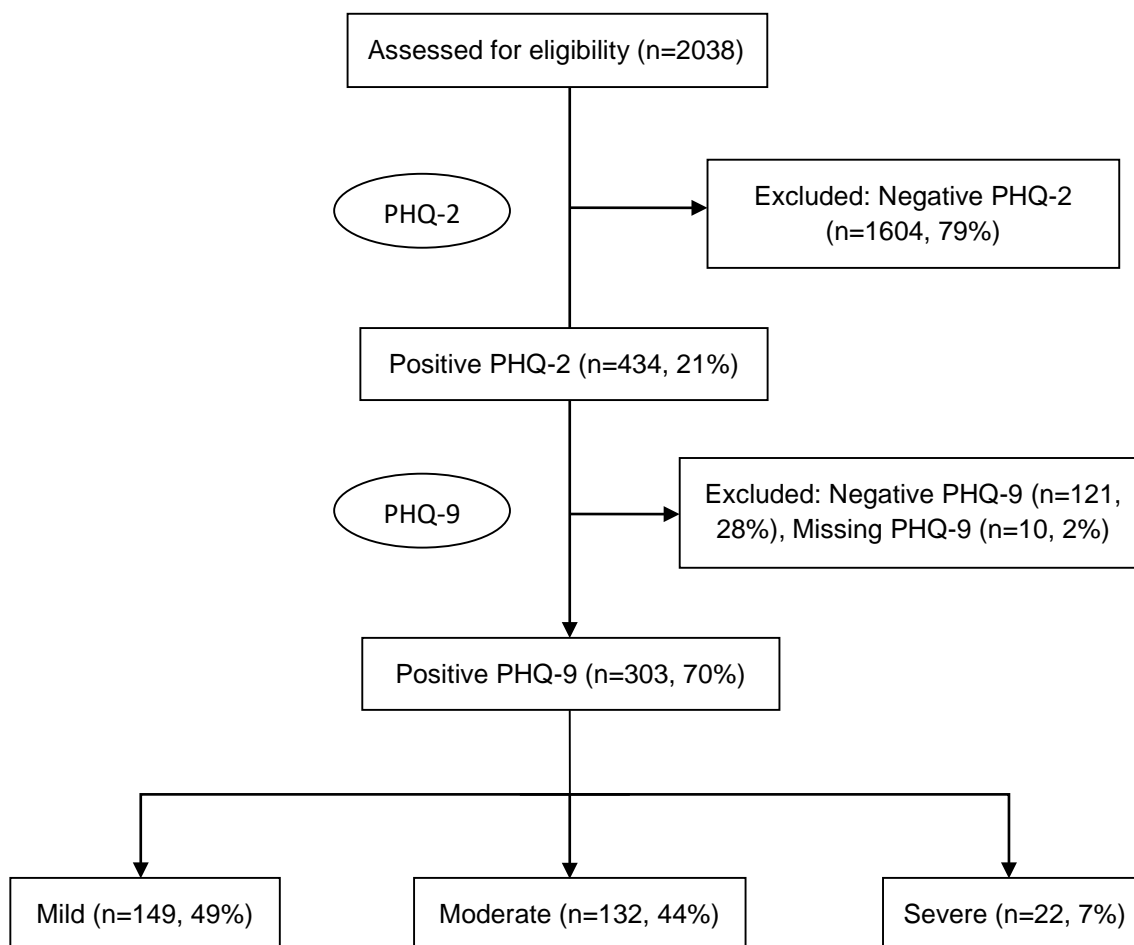


Table 1. Youth demographics, primary physician clinic type, and insurance among participants.

	All youth n=2,038		Elevated PHQ-9 n=303	
	N	%	N	%
Race				
Black	1286	60.3	182	60.1
Hispanic	305	14.3	47	15.5
Other	374	17.5	51	16.8
White	169	7.9	23	7.6
Gender				
Female	1088	51.1	193	63.7
Male	1042	48.9	110	36.3
Mean Age (SD)	14.6 (2.1) 2.1		15.2 (2.1) 2.1	
Insurance				
Public	1134	53.2	179	59.1
Private	103	4.8	6	2.0
Self-pay	148	7.0	25	8.3
Other	746	35.0	93	30.7
Clinic type				
General	1803	84.6	240	79.2
Adolescent	328	15.4	63	20.8
PHQ-9 Interpretation				
Mild			149	49.2
Moderate			132	43.6
Severe			22	7.3
Mean PHQ-9 Score (SD)	All adolescents		10.8 (5.0)	
	Early adolescents (n=121)		10.7 (4.8)	
	Middle adolescents (n=135)		10.5 (5.0)	
	Late adolescents (n=47)		11.9 (4.6)	

Formatted Table

Formatted: Centered

Formatted: Left

Formatted: Right

Formatted: Left

Formatted: Centered

Table 2. Description of physician follow-up for youth in mild, moderate and severe PHQ-9 range.

Follow up items	Mild N=149	Moderate N=132	Severe N=22	<i>p</i> value
Discussed lifestyle changes	45 (30.2%)	36 (27.3%)	1 (4.5%)	0.03
Provided crisis line contact	14 (9.4%)	9 (6.8%)	4 (18.2%)	0.20
In treatment/not interested	19 (12.8%)	8 (6.1%)	4 (18.2%)	0.06
Reviewed support handout	16 (10.7%)	24 (18.2%)	4 (18.2%)	0.16
Referred to psychotherapy	51 (34.2%)	61 (46.2%)	16 (72.2%)	<0.01
Not depressed	34 (22.8%)	26 (19.7%)	0 (0.0%)	0.02
SSRI prescribing/ considerations^a				
Started on SSRI		11 (8. <u>34</u> %)	7 (31.8%)	<0.01
Already on SSRI	<u>7 (4.7%)</u>	14 (10. <u>67</u> %)	5 (22.7%)	0.01
Not depressed	<u>7 (4.7%)</u>	35 (26. <u>57</u> %)	2 (9.1%)	<0.01
Monitor SSRI every 2 wks		16 (<u>12.1</u> <u>16.2</u> %)	4 (<u>21.1</u> <u>18.2</u> %)	<0.01
Ordered TSH	<u>3 (2.0%)</u>	17 (<u>13.0</u> <u>12.9</u> %)	3 (13.6%)	<0.01
Ordered free T4		17 (<u>17.2</u> <u>12.9</u> %)	3 (<u>15.8</u> <u>13.6</u> %)	<0.01
Ordered CBC/UPT	<u>5 (3.4%)</u>	19 (14. <u>45</u> %)	4 (18.2%)	<0.01

^a SSRI recommendations only provided for youth in moderate and severe ranges.